

WHAT IS CLAIMED IS:

- 1 1. A system for forming a connective tissue construct, comprising:
2 a substrate;
3 at least two anchors secured to the substrate in spaced relationship;
4 and
5 fibroblast cells provided on the substrate in the absence of a synthetic
6 matrix, wherein at least some of the cells are in contact with the anchors, the cells
7 cultured *in vitro* under conditions to allow the cells to become confluent between the
8 anchors,
9 wherein the anchors are receptive to the cells and allow the cells to
10 attach thereto while permitting the cells to detach from the substrate to form a three-
11 dimensional connective tissue construct.
- 1 2. The system according to claim 1, wherein the fibroblast cells are
2 derived from tendon tissue.
- 1 3. The system according to claim 1, wherein the fibroblast cells are
2 derived from ligament tissue.
- 1 4. The system according to claim 1, wherein the fibroblast cells are
2 derived from stem cells.
- 1 5. The system according to claim 1, wherein the fibroblast cells self-
2 organize to form the three-dimensional connective tissue construct.
- 1 6. The system according to claim 1, wherein the anchors include silk
2 suture segments coated with cell adhesion molecules.
- 1 7. The system according to claim 6, wherein the cell adhesion
2 molecules include laminin.

1 8. The system according to claim 1, wherein the anchors include a
2 bone-like substrate.

1 9. The system according to claim 1, wherein the substrate is coated
2 with cell adhesion molecules.

1 10. The system according to claim 9, wherein the cell adhesion
2 molecules include laminin.

1 11. The system according to claim 10, wherein the concentration of
2 laminin is about 1.5 to 3.0 $\mu\text{g}/\text{cm}^2$.

1 12. The system according to claim 9, wherein the cell adhesion
2 molecules include thrombin.

1 13. The system according to claim 1, wherein the substrate and
2 anchors are incubated with a growth medium prior to providing fibroblast cells on
3 the substrate.

1 14. The system according to claim 1, wherein the fibroblast cells are
2 disposed in a growth medium prior to becoming confluent, and are disposed in a
3 differentiation medium after becoming confluent.

1 15. The system according to claim 1, wherein the fibroblast cells are
2 supplemented with ascorbic acid.

1 16. The system according to claim 15, wherein the ascorbic acid
2 includes approximately 100 $\mu\text{g}/\text{ml}$ of L-ascorbic acid 2-phosphate.

1 17. The system according to claim 1, further comprising myogenic
2 precursor cells cultured in combination with the fibroblast cells.

- 1 18. A system for forming a tendon construct, comprising:
2 a substrate;
3 at least two anchors secured to the substrate in spaced relationship;
4 and
5 a medium including fibroblast cells and ascorbic acid provided on the
6 substrate, wherein at least some of the cells are in contact with the anchors,
7 wherein the cells are cultured *in vitro* under conditions to allow the
8 cells to self-organize and become confluent between the anchors, and the anchors
9 are receptive to the cells and allow the cells to attach thereto while permitting the
10 cells to detach from the substrate to form a three-dimensional tendon construct.
- 1 19. A method for forming a connective tissue construct, comprising:
2 providing a substrate;
3 securing at least two anchors to the substrate in spaced relationship;
4 providing fibroblast cells on the substrate in the absence of a synthetic
5 matrix, wherein at least some of the cells are in contact with the anchors; and
6 culturing the fibroblast cells *in vitro* under conditions to allow the
7 cells to become confluent between the anchors,
8 wherein the anchors are receptive to the cells and allow the cells to
9 attach thereto while permitting the cells to detach from the substrate and form a
10 three-dimensional connective tissue construct.
- 1 20. The method according to claim 19, wherein providing fibroblast
2 cells includes deriving the fibroblast cells from tendon tissue.
- 1 21. The method according to claim 19, wherein providing fibroblast
2 cells includes deriving the fibroblast cells from tendon tissue.
- 1 22. The method according to claim 19, wherein providing the
2 fibroblast cells includes deriving the fibroblast cells from stem cells.

1 23. The method according to claim 19, wherein culturing the
2 fibroblast cells allows the cells to self-organize to form the three-dimensional
3 connective tissue construct.

1 24. The method according to claim 19, wherein the anchors include
2 silk suture segments coated with cell adhesion molecules.

1 25. The method according to claim 24, wherein the cell adhesion
2 molecules include laminin.

1 26. The method according to claim 19, wherein the anchors include
2 a bone-like substrate.

1 27. The method according to claim 19, further comprising coating
2 the substrate with cell adhesion molecules.

1 28. The method according to claim 27, wherein the cell adhesion
2 molecules include laminin.

1 29. The method according to claim 28, wherein the concentration of
2 laminin is about 1.5 to 3.0 $\mu\text{g}/\text{cm}^2$.

1 30. The method according to claim 27, wherein the cell adhesion
2 molecules include thrombin.

1 31. The method according to claim 19, further comprising incubating
2 the substrate and anchors with a growth medium prior to providing fibroblast cells
3 on the substrate.

1 32. The method according to claim 19, further comprising disposing
2 the fibroblast cells in a growth medium prior to becoming confluent, and disposing
3 the fibroblast cells in a differentiation medium after becoming confluent.

1 33. The method according to claim 19, further comprising
2 supplementing the fibroblast cells with ascorbic acid.

1 34. The method according to claim 33, wherein the ascorbic acid
2 includes approximately 100 µg/ml of L-ascorbic acid 2-phosphate.

1 35. The method according to claim 19, further comprising measuring
2 a functional property of the connective tissue construct and using the measured
3 property as feedback to control the formation of the connective tissue construct.

1 36. The method according to claim 35, wherein the functional
2 property includes a tensile strength of the connective tissue construct.

1 37. The method according to claim 19, further comprising culturing
2 myogenic precursor cells in combination with the fibroblast cells.

1 38. The method according to claim 19, further comprising harvesting
2 the fibroblast cells from mammalian tissue.

1 39. The method according to claim 19, further including implanting
2 the connective tissue construct in a suitable recipient.

1 40. A method for forming a tendon construct, comprising:
2 providing a substrate;
3 securing at least two anchors to the substrate in spaced relationship;
4 providing a medium including fibroblast cells and ascorbic acid on
5 the substrate, wherein at least some of the cells are in contact with the anchors; and
6 culturing the fibroblast cells *in vitro* under conditions to allow the
7 cells to self-organize and become confluent between the anchors,
8 wherein the anchors are receptive to the cells and allow the cells to
9 attach thereto while permitting the cells to detach from the substrate and form a
10 three-dimensional tendon construct.